TABLE 3.—*Comparison of Angström's pyrheliometers.*

Oct. 29, 1901. Time, p. m.	Pyrheliometer No. 28. Ammeter No. 4315. Temperature, C.	Band exposed to sun. Both A and B.	Band exposed to sun. A.	Band exposed to sun. B.	Q. Cal. per sq. cm. per min.	Pyrheliometer No. 34. Ammeter No. 4306. Temperature, C.	Band exposed to sun. Both A and B	Band exposed to sun. A.	Band exposed to sun. B.	Q. Cal. per sq. cm. per min.
	°	*Gal. zero.*	*Amp.*	*Amp.*		°	*Gal. zero.*	*Amp.*	*Amp.*	
1:30	21.6	125	.308	.340	.815	21.2	117	.339	.350	.854
1:37	21.6	134	.295	.338	.795	21.0	106	.341	.350	.864
1:40	21.5	126	.299	.345	.820	21.0	111	.330	.350	.835
1:45	21.4	138	.303	.335	.805	21.0	88	.345	.352	.874
1:47	21.8	126	.300	.340	.810	21.5	95	.347	.341	.855
1:52	21.9	141	.303	.335	.804	21.9	89	.344	.343	.855
1:54	21.5	128	.298	.335	.795	21.9	144	.352	.343	.870
1:57	21.7	145	.295	.330	.770	21.9	148	.341	.341	.841
2:00	21.1	135	.285	.325	.735	21.9	158	.331	.325	.778
2:05	21.0	150	.293	.315	.730	22.0	134	.335	.325	.787
2:09	21.0	134	.297	.310	.725	21.0	186	.315	.364	.835
2:13	21.1	149	.293	.310	.716	21.7	165	.307	.364	.816
2:18	21.0	129	.290	.310	.711	21.6	165	.327	.362	.855
2:25	21.5	150	.252	.306	.698	21.2	130	.300	.357	.777
2:26	21.5	139	.283	.317	.712	21.2	138	.330	.320	.762
2:31	21.2	150	.285	.312	.702	21.0	110	.353	.318	.815
2:34	21.4	142	.282	.312	.698	21.0	116	.348	.298	.758
2:39	21.2	148	.280	.305	.674	21.0	157	.293	.290	.616
2:40	21.2	142	.283	.308	.678	21.1	160	.306	.335	.749
2:44	21.1	155	.275	.301	.655	21.0	113	.330	.333	.796
Mean of 10 pairs of observations...			.7424							.8096

The constants of the instruments were very carefully determined by Knut Angström, and are combined in the following table:

TABLE 4.—*Constants of pyrheliometers.*

	No. 28.	No. 31.	No. 34.
Electrical resistance of the bands at 20° C. (r)	0.0810	0.0731	0.0751
Coefficient of variation of resistance with temperature	.00045	.00045	.00045
Width of bands (b) centimeters	0.150	0.150	0.152
Absorbing power of the surfaces (a)	0.98	0.98	0.98

The intensity of radiation is given by the relation

$$Q = \frac{r\,i^2}{4.19\,b\,a} 60 \text{ gram-calories per min. per cm.}^2$$

Or $$Q = k\,i^2.$$

(i = intensity of the current in amperes.)

The coefficient k has, at different temperatures, the following values:

TABLE 5.

Temperature, C.	−10°	0°	10°	20°	30°	40°
Instrument.	k.					
No. 28	7.80	7.83	7.87	7.90	7.94	7.97
No. 31	7.02	7.06	7.09	7.13	7.16	7.19
No. 34	7.12	7.15	7.19	7.22	7.26	7.29

NOTES BY THE EDITOR.

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. George E. Franklin, Local Forecast Official, Los Angeles, Cal., has given instruction to the class in physical geography of the Los Angeles High School in the construction and use of meteorological instruments and the general work carried on at stations of the Weather Bureau. For this purpose the class, which numbers about 150, visited the local Weather Bureau office in sections on different days during the latter part of the month. Similar instruction is to be given to the pupils of other schools during the winter.

Mr. A. E. Hackett, Section Director, Columbia, Mo., has undertaken the instruction of a class in climatology in the Missouri State University. The class meets each Friday during the first semester and a greater portion of the time will be devoted to the study of the more important climatic features of the various sections of the United States. This course is now required in the Missouri State University for the degree of Bachelor of Science in Agriculture.

Mr. H. W. Richardson, Local Forecast Official, Duluth, Minn., reports that on October 24 he addressed the senior class of the Convent of the Sacred Heart at his office, the topic being the United States Weather Bureau. On October 29, the senior class of young ladies from the Craggencroft Private School, Duluth, Minn., visited the office and after explaining the various instruments, Mr. Richardson addressed them upon Weather Forecasting and the Work of the United States Weather Bureau.—*H. H. K.*

APPLIED CLIMATOLOGY.

By practical climatology we ordinarily mean the observing and recording of the weather, the preparation of mean values and the application of this climatological knowledge to the benefit of mankind. Practical meteorology implies similar observations but a different form of record, i. e., the daily weather map and the study and prediction of storms and changes in the weather.

There are many other fields for the application of our knowledge of climatology and one of the most interesting is that branch of geography called physiography or the study of the action of the atmosphere in altering the surface features of the earth.

As many of the readers of the MONTHLY WEATHER REVIEW are teaching geography, climatology, and physiography, we believe that they will often find opportunity to utilize ideas drawn from the following outline of the subjects treated of by Prof. Dr. George B. Shattuck of Johns Hopkins University in his recent course of public lectures in Baltimore.

GEOGRAPHY OF NORTH AMERICA.

LECTURE I.

SUBJECT.—PHYSIOGRAPHIC FEATURES OF NORTH AMERICA.

Relations of continental plateaus and ocean basins.—Methods of sounding: lead line; Sigsbee sounding machine. Contour of ocean bottom: levels; ridges; deeps. Contour of continental plateaus: continental shelf; submarine earthquakes; cable ruptures.

Relations of North America to the other continents and to the surrounding ocean basins.—Atlantic basin; Pacific basin; Arctic basin; Antillian basin.

Hypsometric features of North America.—Atlantic Plain: position; extent; characteristics; subdivisions—Coastal Plain, Piedmont Plateau. Appalachian Mountain System: position; extent; characteristics; subdivisions—Blue Ridge, Appalachian Valley, Cumberland-Allegheny Plateau. Great Central Plain: position; extent; characteristics; subdivisions—Laurentian Highlands, Mackenzie River Basin, St. Lawrence Valley, Mississippi Valley, Prairie Steppes, Black Hills, Ozark Mountains, Llano Estacado, Bad Lands. Cordilleran Mountain System: position; extent; characteristics; subdivisions—Rocky Mountains, Plateau Country, Great Basin, Coast Ranges. Antillian Mountain System: position; extent; characteristics; subdivisions—Greater Antilles, Lesser Antilles, Bahamas, Trinidad-Tobago group, Mountains of Central America.

LECTURE II.

SUBJECT.—CLIMATOLOGY AND HYDROGRAPHY.

Climatology.—Definition of climate: precipitation: evaporation; circulation; condensation; storms; distribution of rainfall. Temperature: heat in atmosphere; ocean currents—horizontal, vertical; mean annual temperature; variation in temperature.

Hydrography.—Drainage basins of North America: Atlantic; St. Lawrence; Hudson Bay; Arctic; Bering Sea; Pacific; Gulf of Mexico. Harbors of North America: conditions necessary for good harborage. Nature and origin of harbors: delta harbors; drowned river harbors; lagoon harbors; moraine harbors; coral reef harbors. Geological actions which tend to improve or depreciate harbors. Harbors of North America: for a discussion of this topic see 13th Annual Report, United States Geological Survey, pp. 160–209. Lakes of North America: lakes of Glacial origin; coastal lagoon lakes; river lagoon lakes; closed basin lakes; lakes formed by mountain movements.

LECTURE III.

SUBJECT.—CONTINENTAL GROWTH OF NORTH AMERICA.

Geologic Time.—Subdivisions of the time scale; age of the earth.
Evolution of life.
Pre-Cambrian Time.—Beginning of geologic history; Algonkian land masses; life in pre-Cambrian Time.
North America in Paleozoic Time.—Cambrian; Silurian; Devonian; Carboniferous.
North America in Mesozoic Time.—Triassic; Jurassic; Cretaceous.
North America in Cenozoic Time.—Eocene; Miocene; Pliocene; Pleistocene.
Conclusion.—Permanency of the North American Continent.

LECTURE IV.

SUBJECT.—MINERALS AND SOILS OF NORTH AMERICA.

Nonmetallic minerals.—Coal; petroleum; natural gas; phosphates; origin, geologic and geographic distribution.
Metals.—Placer deposits: chemical deposits: unstratified deposits; veins—origin, structure, dip, strike.
Modification of deposits by earth movement.
Geographic distribution of metals.—Gold; silver; copper; lead; zinc; tin; nickel.
Origin of soils.—Wind; rain; rivers; frost; glaciers; animals.
Soil texture.
Soil structure.
Distribution of soils.

PHYSIOGRAPHY.

LECTURE I.

SUBJECT.—THE GEOLOGICAL WORK OF THE ATMOSPHERE.

Geologic circulation.—Uplift; erosion; transportation; sedimentation.
Atmospheric agencies.—Physics of atmosphere: upward extent of atmosphere; weight of atmosphere; composition of atmosphere; heat in atmosphere—source, variation; absorption in atmosphere—absorption of moisture, condensation of moisture; moisture in atmosphere—convection, circulation, storms.
Weathering effects of atmosphere.—Changes of temperature: mechanical effects of wind: on land—removal, etching; on water—waves, currents, change of level.
Transporting effects of atmosphere.—Arid regions.
Sedimentation from atmosphere.—Dunes; ponded rivers; formation of soil; loess.

LECTURE II.

SUBJECT.—GEOLOGICAL WORK OF RAIN.

Cause of rain.
Erosive effects of rain.—Chemical work; caverns; mechanical work; impact; earth pillars.
Transporting effects of rain.—Material carried in solution; material carried in suspension; landslides.
Sedimentation due to rain.—Fossilization; spring deposits; cave deposits.

LECTURE III.

SUBJECT.—GEOLOGICAL WORK OF RIVERS.

Sources of supply.
Avenues of loss.
Erosive effects.—Chemical action; mechanical action.
Kinds of erosion.—Filing; pot holes; recession of falls; ox bows; recession of cliffs.
Transporting effects of rivers.—Substances carried in solution; substances carried in suspension.
Sedimentation of rivers.—Cause of deposition; alluvial cones; deltas; flood plains; terraces.

LECTURE IV.

SUBJECT.—GEOLOGICAL WORK OF RIVERS.

Cycle of a river.—Youth; adolescence; maturity; old age.
Antecedent.
Revived.
Superimposed.
Resurrected.
Adjusted.
Beheaded.
Captured.
Drowned.
Diverted.

THE BAROMETER AS USED AT SEA.

Ever since the first International Meteorological Congress at Vienna, in 1873, there has been a steady movement toward the full recognition of the general principle that atmospheric pressure is not correctly expressed by the height of a column of mercury unless that height be corrected for the effect of the variations in gravity as well as variations in temperature. The correction for gravity was early adopted by the Weather Bureau, by an order of General Hazen, so far as concerns observations at land stations, and probably at the present time no national service would do violence to modern science by neglecting this. On the other hand all must admit that if the effect of a change of gravity is important for the land, it is equally so for the ocean; it must be perceived that in this matter uniformity of practise is best and that the reduction to standard gravity ought to be applied to all mercurial barometers and to the isobars of all charts.

We are very glad to see that the United States Hydrographic Office has taken the proper stand in this matter, and is preparing to issue on its pilot chart isobars of standard pressures. We print the following extract from a recent instruction by Capt. C. C. Todd, Hydrographer, U. S. N., addressed to all branch hydrographic offices, and relating, as we understand, not only to the daily international simultaneous observations at 1 p. m., Greenwich time, but also to all other barometric work:

The adoption of a new form of barometer comparison card renders necessary the following instructions as to the use of the cards. Attention is also called to those paragraphs of Hydrographic Office Publication, No 119, referring to the subject of barometer comparisons.

* * * * * * *

Upon receipt of each card see that the character of the ship's barometer, whether mercurial or aneroid, is indicated in the appointed place.

If the ship's barometer is mercurial the reading given by the observer should be corrected by you for temperature, using for this purpose Table 3 of the "Barometer Correction Card" and reduced to standard gravity according to the Table 2 given below. The result is to be neatly entered in red ink in column 2 of the card.

If the ship's barometer is aneroid, neither of these corrections is necessary and column 2 should be left blank.

You will ascertain the reading of the office standard barometer at the given time of observation aboard ship. If the standard is mercurial the reading must be corrected for temperature, initial error, height above sea level, and reduced to standard gravity. If the standard is aneroid, it must be corrected for initial error and height above sea level.

The reduction to sea level is additive, and amounts to one hundredth inch (0.01) for each ten (10) feet of elevation. (See Table 1.) Enter the reading of the standard thus corrected in the third column of the card in red ink.

In column 4 enter, in red ink, the difference between the corrected reading of the ship's barometer and the corrected reading of the office standard, prefixing a plus (+) sign if the ship's barometer reads lower than the standard, a minus sign (—) if the ship's barometer reads higher than the standard. Divide the algebraic sum of these differences by the total number of readings and enter the result at the foot of the column, prefixing the proper sign.

All readings should be to the nearest hundredth of an inch and no further. Promptly forward the completed cards to the main office.

Comparisons should be made on several different days; not several on the same day. Readings on at least three (3) different days are necessary for a satisfactory determination of the error of the ship's barometer.

The standard barometer (both mercurial and aneroid) of the branch office should be compared once a week with the local standard of the United States Weather Bureau. In case of any discrepancy the latter